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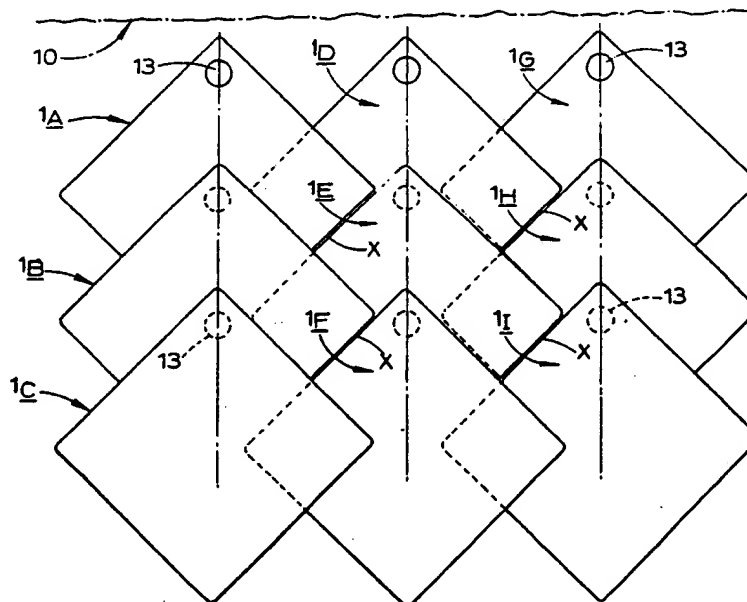
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>5</sup> :  F41H 1/02, 5/04</p>	<p>A1</p>	<p>(11) International Publication Number: WO 92/08094  (43) International Publication Date: 14 May 1992 (14.05.92)</p>
<p>(21) International Application Number: PCT/GB91/01940 (22) International Filing Date: 5 November 1991 (05.11.91)  (30) Priority data: 9024078.9 6 November 1990 (06.11.90) GB 9117346.8 10 August 1991 (10.08.91) GB  (71) Applicant (for all designated States except US): EURO-COURT LIMITED [GB/GB]; 1 West Dean, Salisbury, Wiltshire SP5 1JF (GB).  (72) Inventors; and (75) Inventors/Applicants (for US only) : LEECH, David, John [GB/GB]; Sandy Lodge, Wyndham Lane, Allington, Salisbury SP4 0BY (GB). AYLIFFE-JONES, Noel [GB/GB]; 1 West Dean, Salisbury, Wiltshire SP5 1JF (GB).</p>		<p>(74) Agent: BARKER, BRETTELL &amp; BOUTLAND; Prudential Buildings, Room 24, 97-101 Above Bar Street, Southampton SO9 4GT (GB).  (81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB, GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.  Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>

(54) Title: IMPROVEMENTS IN OR RELATING TO BODY PROTECTING CLOTHING



(57) Abstract

Body protecting clothing comprising a plurality of protective elements (1) formed and arranged so as to at least impede intended contact by a stabbing weapon with the body of the wearer of the clothing. The elements (1) are of impact-resistant glass composite material, comprising layers of glass fibre impregnated with resin and are mounted on a flexible support sheet (10). The material of the support sheet (10) is a close-woven fabric defining a plurality of mesh holes (11). The element (1) is attached to the sheet (10) by way of a small rivet-like attachment (12) which is located by a hole (13) formed in the upper end of the element and by one of the mesh holes (11) in the sheet (10), the mesh hole (11) allowing enlargement to receive the attachment (12). The element (1) is thus suspended by the fixing attachment (12).

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IMPROVEMENTS IN OR RELATING TO BODY PROTECTING CLOTHINGBACKGROUND TO THE INVENTION

5 This invention relates to body protecting clothing and is particularly, but not exclusively, concerned with protection of a wearer's torso.

Increasing violence by criminals against the police and other law-enforcing officers requires body protecting clothing.

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Some clothing provides a good measure of protection against bullets and shotgun pellets, but rather poor protection against attempts at stabbing using a sharp-pointed weapon, such as a dagger.

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The present invention provides body protecting clothing which is intended primarily to protect the wearer against a stabbing attack but which also protects him or her from missiles such as bullets, shotgun pellets and crossbow bolts (hereinafter referred to collectively as missiles).

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SUMMARY OF THE INVENTION

According to the invention, body protecting clothing comprises a plurality of overlapping protective elements, formed and arranged so as to at least impede intended contact by a stabbing weapon with the  
25 wearer's body.

Contact may be impeded by deflection or by resistance to penetration, depending on the direction of movement taken by the stabbing weapon.

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The protective elements are preferably mounted on sheet material, and may be covered by sheet material also.

Each protective element preferably has a cross-section of stepped form which defines a plurality of pockets which tend to deflect the point  
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of a stabbing weapon entering the pockets.

Each protective element is preferably curved in two dimensions.

- 5 The invention also comprises a protective element per se.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The various aspects of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:

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Figure 1 is a front view of a protective element,

Figure 2 is a sectional view, taken on the lines II-II of Figure 1,

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Figure 3 is a plan view, looking in the direction of the arrow III of Figure 1,

Figure 4 is a rear view of the element,

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Figure 5 is a fragmentary front view of sheet material on which the element is mounted,

Figure 6 shows how the elements are disposed in an overlapping pattern.

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Figure 7 is a front view of the modified protective element,

Figure 8 is a sectional view taken on the lines VIII-VIII of Figure 7,

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Figure 9 is a side view, looking in the direction of the arrow IX of Figure 7, and

Figure 10 is a bottom end view of the modified element, looking in the direction of the arrow X of Figure 7.

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In the Figures, like reference numerals refer to like components and features.

DETAILED DESCRIPTIONS OF THE PREFERRED EMBODIMENTS

5 With reference to Figures 1, 2 and 3, a one-piece protective element 1 forming part of body protecting clothing (Figure 6) is of elongate form and comprises, in effect, three integral overlapping square-shaped portions 2a, 2b, 2c of equal size, disposed lozenge-like along the longitudinal axis 3 of the element 1. As explained hereinafter, a  
10 plurality of protective elements 1 are formed and arranged so as to at least impede intended contact by a stabbing weapon with the body of the wearer of the clothing.

As best shown in Figures 2 and 4, the element 1 has a longitudinal  
15 cross-section of stepped form which defines two angular pockets 4, 5 formed in the rear face 6 of the element 1. The pockets 4, 5 are wedge-shaped, each defining an isosceles triangle with a 90° apex, disposed uppermost. The bottoms (or bases) of the pockets 4, 5 are open.

20 The element 1 is of impact-resistant glass composite material, comprising layers of glass fibre impregnated with resin.

The element 1 is curved in two dimensions, namely in width and length.  
25 As shown in Figure 3, the element 1 curves rearwardly at about 5° each side of the longitudinal axis 3 (Figure 1).

With reference to Figure 2, the element 1 also curves rearwardly at a radius of about 500 mm along the same axis 3.

30 With reference to Figure 5, the element 1 is mounted on a flexible support sheet 10 together with other identical elements. The material of the support sheet 10 is a close-woven fabric defining a plurality of mesh holes 11. The element 1 is attached to the sheet 10 by way of

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a small rivet-like attachment 12 which is located by a hole 13 (Figure 1) formed in the upper end of the element and by one of the mesh holes 11 in the sheet 10, the mesh hole 11 allowing enlargement to receive the attachment 12 when pushed through the hole. The element 1 is thus  
5 suspended by the fixing attachment 12. The element 1 may be restrained from excess pivotal movement about the attachment 12 by at least one hook forming part of the element and insertable into an adjacent mesh hole 11. The attachment is suitably a rivet of the type in which an axial pin splays apart a plurality of legs when the pin is  
10 urged axially. Amari Plastics supply such rivets.

The element 1 illustrated has an overall length of 90mm, an overall width of 50mm, and each portion 2a etc has a thickness of 2mm.

15 Figure 6 illustrates how body protecting clothing in the form of a sleeveless jacket (not shown) may be formed, so as to protect a wearer's torso.

The jacket is constructed so that it can be used on persons of varying  
20 size, having overlapping side portions secured together by 'VELCRO' (Registered Trade Mark) fasteners.

Basically the jacket comprises the sheet material 10 upon which are mounted rows of identical elements 1. For ease of understanding,  
25 these elements are shown in Figure 6 as 1A, 1B, 1C etc, each element having a separate alphabetical reference.

Mounted on the base sheet material 10 is a first downwardly- extending row of elements comprising 1A, overlapped by 1B, overlapped in turn by  
30 1C.

Row 1A, 1B, 1C overlaps an adjacent row comprising elements 1D, 1E, 1F, which in turn overlaps an adjacent row comprising elements 1G, 1H, 1I.  
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The overlapping pattern is repeated, both laterally and longitudinally, until substantially the whole of the sheet 10 is covered.

- 5 Preferably the overlap is in opposite senses on opposite sides of a vertical centre line of a jacket front.

10 The overlapping elements are then covered by a first sheet, which tends to restrain movement of the elements, and then by a further sheet, which comprises a hygienic covering of washable Polycotton material.

At least two overlapping elements is preferred at any one point. However, the more elements used, the better the protection.

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A frontal stabbing, that is to say a stabbing movement made substantially normal to an element 1, is at least impeded by that element and the element(s) it overlaps. It is also impeded by deflection caused by the curved outer surface(s) of the element(s).

- 20 Resistance builds up as the stabbing weapon attempts to further penetrate. Similarly, resistance builds up to any frontal assault by a missile such as a bullet.

25 A stabbing movement which results in the blade of the weapon entering between an overlapping pair of elements 1 is deflected away from the body by contact with the sides of one or more of the wedge-like pockets 4, 5 (Figure 4)

- 30 Tests indicate that attacks by all forms of weapons and missiles in direction substantially normal to the elements 1 and at 42 joules energy are prevented from harmful penetration by the present invention.

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The shape and horizontal spacing of the rows is such that locating abutments occur at places X.

5 With reference to Figures 7, 8, 9 and 10, a modified one-piece protective element 101 forming part of body protecting clothing is of elongate form and comprises, in effect, three integral overlapping generally square-shaped portions 102a, 102b, 102c of equal size, disposed lozenge-like along the longitudinal axis 103 of the element 101.

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As best shown in Figures 8 and 9, the element 101 has a longitudinal cross-section of stepped form which defines two angular pockets 104, 105 formed in the rear face 106 of the element 1. The pockets 104, 105 are wedge-shaped, each defining a triangle with unequal sides and  
15 a 90° apex disposed uppermost. The bottoms (bases) of the pockets 104, 105 are open-ended.

The element 101 is of impact-resistant glass composite material, comprising layers of glass fibre impregnated with resin.

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The element 101 is curved in two dimensions, namely in width and length. As shown in Figure 10, the element 101 curves rearwardly at about 2° each side of the longitudinal axis 103 (Figure 7).

25 With reference to Figure 8, the element 1 also curves rearwardly at a radius of about 1000 mm along the same axis 3.

The element 101 is mounted on a flexible support sheet 110 together with other identical elements. As in the case of the first-described  
30 embodiment, the material of the support sheet 110 is a close-woven fabric defining a plurality of mesh holes. The element 101 is attached to the sheet by way of a small diameter peg 112 formed integrally in the upper end of the element and by one of the mesh holes in the sheet, the mesh hole allowing enlargement to receive the  
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peg 112. The element 101 is thus suspended by the peg 112. The element 101 may be restrained from excess pivotal movement about the peg 112 by a peg 120 forming an integral part of the element and insertable into a mesh hole of a covering sheet. Star washers are  
5 secured to the pegs 112, 120 to secure an element 101 in place.

As shown in Figure 7, the element 101 has a front face profile wherein the overlapping portions 102a, 102b, 102c, provide the element with a continuous right hand side or edge extending substantially parallel to  
10 axis 103. This is achieved by extending to the right the right hand parts of portions 102a, 102b.

This increase in area increases overlap of elements 101 and results in a body protecting clothing even less vulnerable than clothing  
15 employing elements 1 (see Figure 6).

In addition, extending the lower left hand corner 126 of the lowermost portion 102c outwardly and downwardly results in covering of the joints between adjacent elements 101 disposed below. Again, even less  
20 vulnerability is achieved.

Additional protection from strikes in directions almost parallel to an element 101, which might allow a blade to slide between a pair of overlapping elements, can be achieved by providing overlapping discs  
25 of Nylon 66 fixed to the inner surface of the innermost mesh covering. The discs serve to ensure that the blade direction remains parallel to the elements 101 and so prevent penetration into the wearer's body.

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CLAIMS

1. Body-protecting clothing comprising a plurality of overlapping protective elements (1, 101), formed and arranged so as to at least  
5 impede intended contact by a stabbing weapon with the wearer's body.
2. Body protecting clothing as claimed in claim 1 wherein the protective elements (1, 101), are mounted on sheet material (10, 110).
- 10 3. Body protecting clothing as claimed in claim 2, wherein the protective elements (1, 101) are mounted on the sheet material (10, 110) so as to suspend therefrom.
- 15 4. Body protecting clothing as claimed in claim 1, 2 or 3 wherein the protective elements (1, 101) are covered by sheet material (not illustrated).
- 20 5. Body protecting clothing as claimed in any of claims 1 to 4, wherein each protective element (1, 101) has a cross-section of stepped form which defines a plurality of pockets (4, 5; 104, 105) which tend to deflect the point of a stabbing weapon entering the pockets.
- 25 6. Body protecting clothing as claimed in claim 5 wherein the pockets are wedge-shaped.
7. Body protecting clothing as claimed in any one of claims 1 to 6 wherein each protective element (1, 101) is curved in two dimensions.
- 30 8. Body protecting clothing as claimed in any one of claims 1 to 7 wherein the protective elements (1, 101) are of impact resistance glass composite material.

9. Body protecting clothing as claimed in any one of claims 1 to 8 wherein each protective element (1, 101) is of elongate form and comprises, in effect, a plurality of integral overlapping square-shaped portions (2a, 2b, 2c; 102a, 102b, 102c), disposed  
5 lozenge-like along the longitudinal axis (3, 103) of the element.

10. Body protecting clothing as claimed in any one of claims 2 to 9 wherein the sheet material (10, 110) on which the protective elements (1, 101) are mounted comprises fabric defining a plurality of mesh  
10 holes (11, 111).

11. Body protecting clothing as claimed in claim 9 or 10, wherein the protective elements (1, 101) each have a front face profile whereby the overlapping portions provide the element with a continuous  
15 right hand edge.

12. Body protecting clothing as claimed in claim 11, wherein the said right hand edge extends substantially parallel to the longitudinal axis of the element.  
20

13. Body protecting clothing as claimed in claim 11 or 12, wherein the lower left hand corner of the lowermost portion extends outwardly and downwardly so as to cover the joint between the edges of adjacent protective elements disposed below.  
25

14. Body protecting clothing as claimed in any one of claims 1 to 13 wherein the protective elements (1, 101) are disposed in downwardly extending, overlapping, rows.

30 15. A protective element, per se, of body protecting clothing claimed in any one of claims 1 to 14.

16. Body protecting clothing, substantially as hereinbefore described, with reference to Figures 1 to 6, or to Figures 7 to 10 of  
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the accompanying drawings.

17. A protective element substantially as hereinbefore described,  
with reference to Figures 1 to 6, or to Figures 7 to 10 of the  
5 accompanying drawings.

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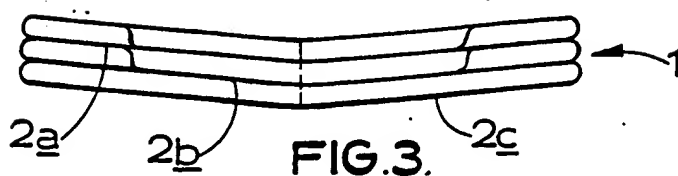
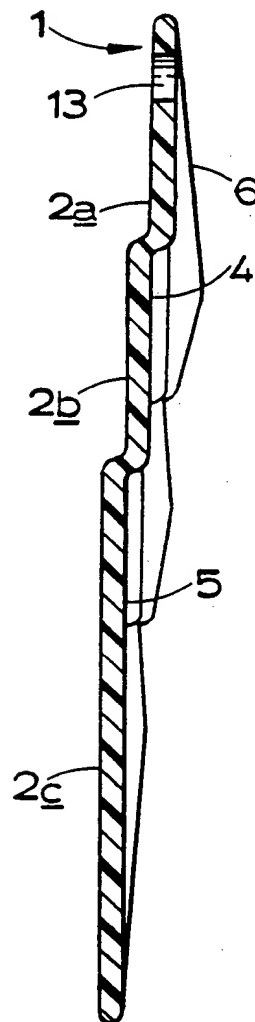
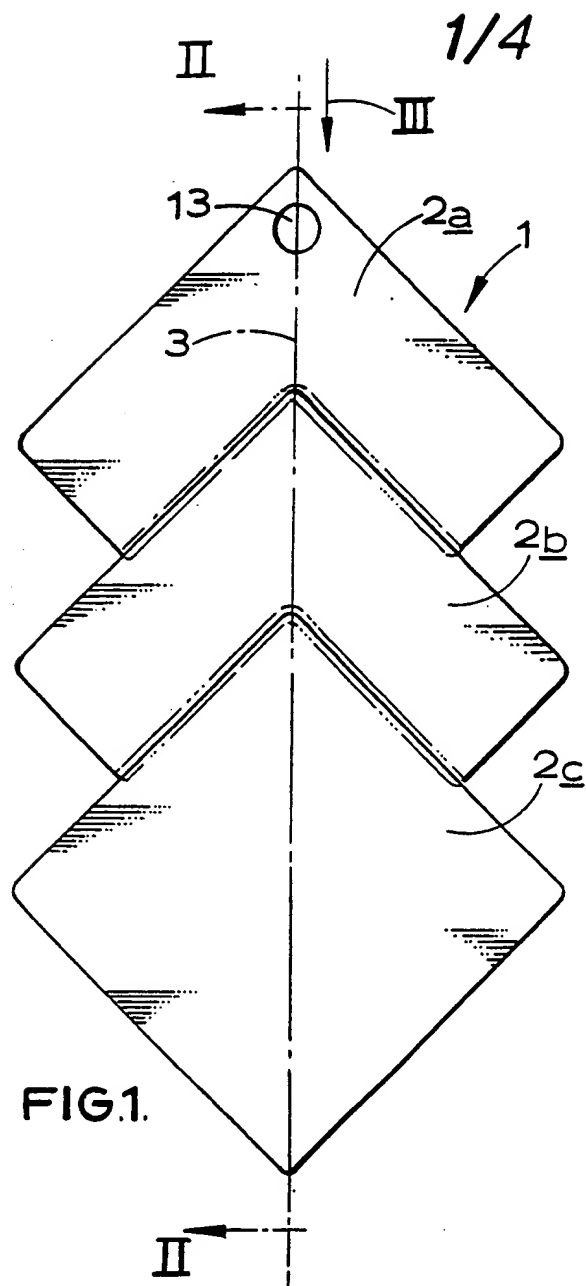
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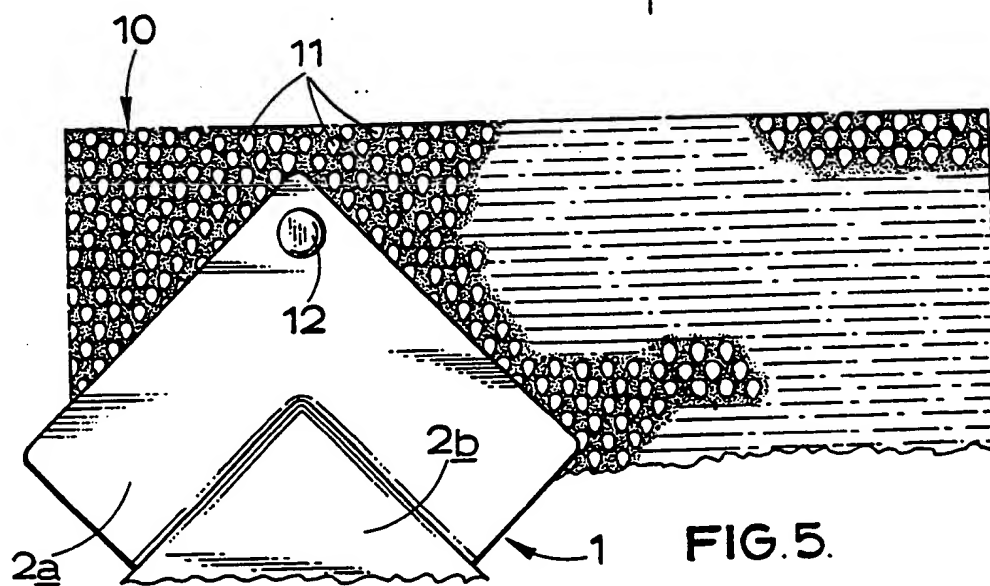
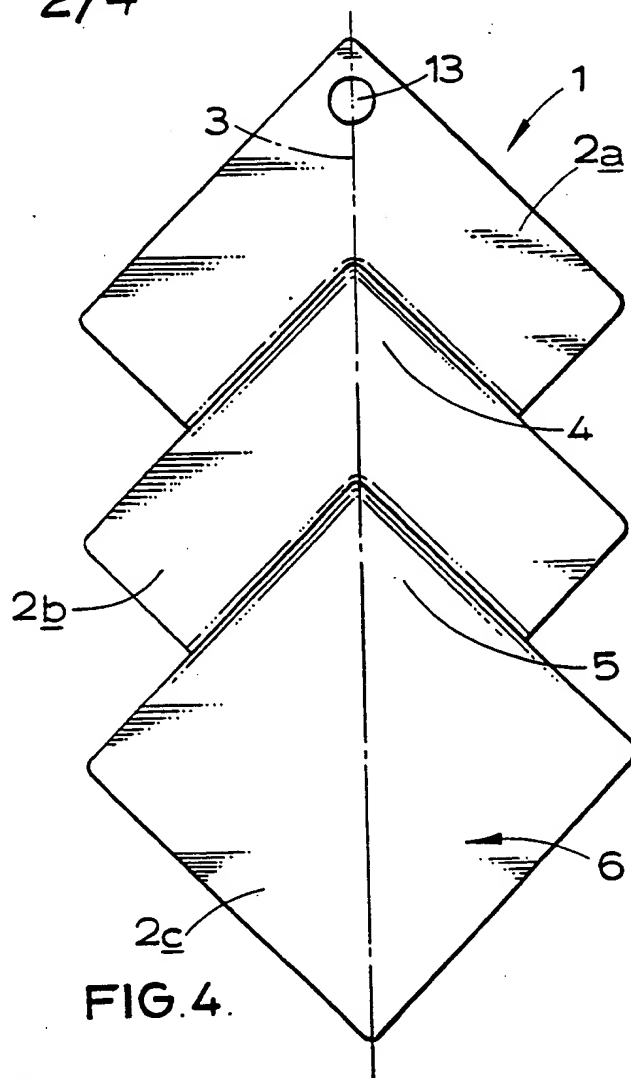
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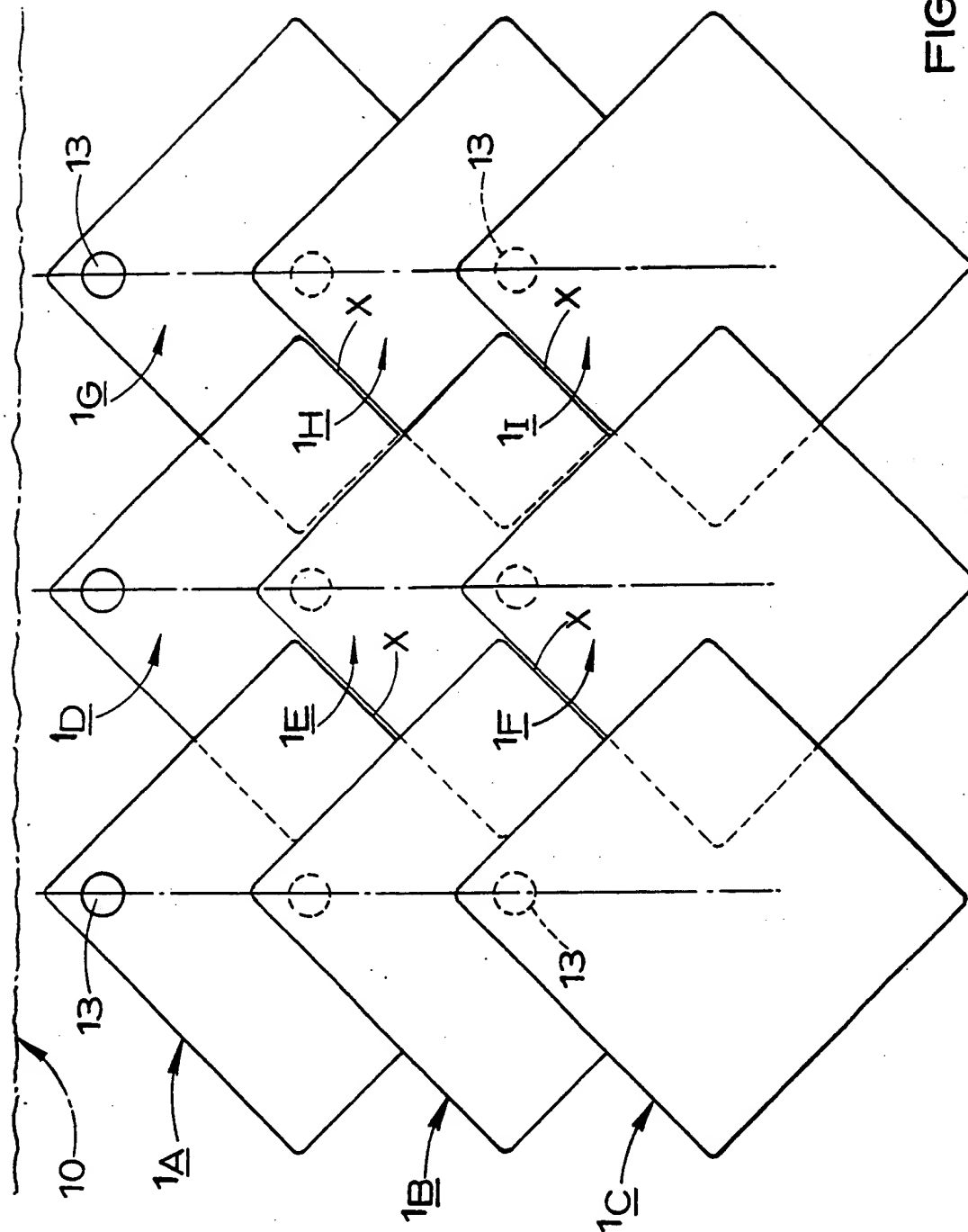
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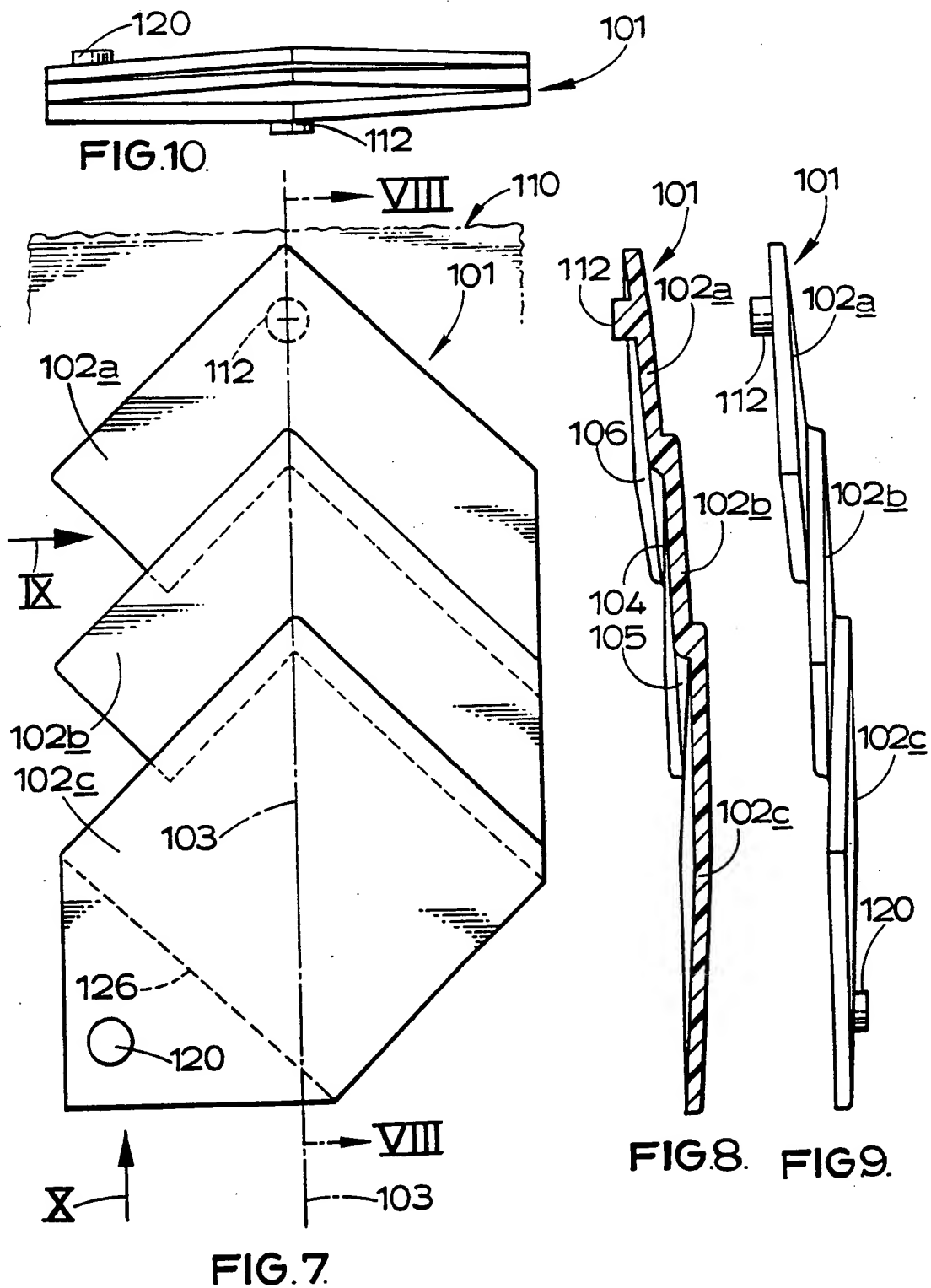
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4/4

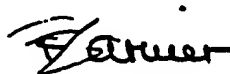




## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 91/01940

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 F41H1/02; F41H5/04		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	F41H ; A41D	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	EP,A,0 226 265 (C. ITOH & CO LTD) 24 June 1987 see column 3, line 40 - column 7, line 12; figures 1-8 ---	1, 4, 8 9, 14-17
X	GB,A,425 066 (R. DWORACZEK) 6 March 1935 see page 1, line 67 - page 2, line 57; claims 1-6; figures 1-4 ---	1, 2, 4 5, 14-17
X	WO,A,8 806 413 (FRISTADS AB) 7 September 1988 see page 4, line 8 - page 10, line 31; figures 1-8 ---	1, 2, 4 14-17
<p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
19 FEBRUARY 1992	23.03.92	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	GARNIER F.M.A.C. 	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. GB 9101940  
SA 53061**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on  
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		CA-A- 1246373	13-12-88
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GB-A-425066		BE-A- 399955	
		CH-A- 176668	
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WO-A-8806413	07-09-88	SE-B- 459141	12-06-89
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